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CRINKLED FABRIC AND METHOD OF PRODUCING THE SAME

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1 Claim. (Cl. 8—114.5)

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This invention relates to a crinkled fabric and to a method of producing the same.

Heretofore a fabric has been given a plissé surface having the appearance of seersucker cloth by printing thereon spaced bands of a gum or other removable resist and then passing the cloth through a bath of caustic alkali, such as a cold 20% aqueous solution of NaOH, capable of shrinking the cloth abnormally, such as 10 to 20% in length. The gum resist temporarily protects the printed portions from shrinkage, and these protected portions are therefore caused to pucker or form crinkles. Since the gum is ultimately removed from the cloth, as in laundering operations, it is necessary that the abnormal shrinkage of the unprotected areas be materially greater than that normal shrinkage which subsequently takes place in the now exposed areas originally protected by the resist. Hence the process requires an abnormal shrinkage and a wasteful decrease in cloth length.

The production of such plissé cloth requires the use of a cloth of normal texture made of standard or normally twisted yarn or thread, as distinguished from crepe cloth. The latter is made by twisting the warp threads highly and weaving a cloth to provide alternate strands of left and right hand twist in the warp. The woven crepe cloth has a generally smooth appearance, and the crepe effect is produced by subjecting the cloth to an abnormal shrinkage, such as by means of a caustic alkali solution, which causes the highly twisted strands to become kinked, crooked or wavy. Any printing of resist patterns on crepe, as has been heretofore proposed, merely produces a patterned effect formed of interspersed creped and non-creped areas. Hence, in the previous methods of making both plissé and creped cloth, there has been an abnormal shrinkage requiring a material loss of cloth length.

It is the primary object of this invention to make a plissé or a crinkled cloth without requiring abnormal shrinkage thereof.

A further object of the invention is to make a crinkled fabric from a cloth of standard texture by employing a permanent resist and subjecting the non-protected areas to a normal shrinkage and thus avoiding a material loss in yardage.

Further objects of the invention are to make a crinkled cloth in which the crinkled portions having a lustrous appearance and to provide a pleasing contrast between the crinkled and the smooth areas and wherein either portion of the

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cloth may have desired dye effects. Other objects will be apparent in the following disclosure.

In accordance with this invention, we propose to make a crinkled, raised pattern or plissé cloth from a non-crepe cloth, or one of standard texture made of normally twisted yarns which has no artificial shrinkage, by printing that cloth in a stretched condition with a hardenable resist capable of permanently immobilizing the stretched condition of the cloth without detrimentally affecting its pliability, after which the resist is hardened or insolubilized and the cloth is then subjected to a normal shrinking step, such as is involved in a standard slack laundering or a sanforizing operation, which shrinks the non-printed areas and causes the resist printed areas to crinkle. The stretched condition may be obtained by employing a standard bleach processing operation which serves to lengthen the cloth warp-wise. The cloth may be printed in that stretched condition and without the imposition of further tension, or it may be subjected to tension to cause stretching thereof in the desired direction. The desired pattern may be printed on the cloth by means of a permanent resist, such as a paste containing polymerizable resin components capable of being thereafter hardened, or a thermoplastic polymerized resin, or a resin in an intermediate state of polymerization which may be subsequently brought to a final insoluble condition.

Wide variations in the crinkled pattern may be made, depending on the shape and arrangement of the localized areas of the printed resist. For a plissé cloth, we may print it with bands of resin spaced by unprinted portions of the same or a different width. These bands may run either warp-wise or filling-wise of the cloth, depending upon the stretched condition thereof. For example, if the grey cloth has been subjected to a standard bleach processing operation and increased in length, that cloth may be considered to be in a warp-wise stretched condition. In that case, the bands of resin are printed warp-wise of the stretched cloth, such as by means of a printing roll having parallel circular printing bands engraved thereon. However, the cloth may have been initially framed or otherwise stretched filling-wise or cross-ways of the piece, and then it is desirable to print the bands length-wise of the filling, such as by means of a printing roll having parallel bands of engraving spaced around its periphery and parallel with the axis of the printing roll.

The cloth may have been initially dyed to a

desired color, and the resin resist may contain a suitable printing color therein in order to give desired pleasing effects. Whether or not the cloth was initially dyed, or the resin contains a color, the cloth may be subjected to a further dyeing operation after the resin has been insolubilized and thus impart a color to the non-printed portions. Also, the cloth may be subjected to a glazing operation prior to the final hardening of the resin resist. This causes the nap to lie in a polished condition throughout the entire surface of the cloth. Then, upon subjecting the resin to its final hardening process, that glazed or polished condition of the resin printed areas is rendered permanent, while the subsequent shrinking and laundering operations remove the glaze previously applied to the unprinted areas. Thus the final effect is the pleasing one in which the crinkled resin printed parts are glazed and may have special color schemes, while the remainder of the cloth has a matt or unglazed appearance.

In order to obtain the stretched condition, the fabric may be subjected to various types of treatment. We, however, preferably employ a standard bleach processing treatment. For example, an unbleached cloth, herein termed a "grey" cloth, may be subjected to a bleaching process involving the general steps of kier boiling the cloth under pressure with a weak caustic alkali solution, after which the cloth is washed with water, treated with a dilute aqueous sulphuric acid solution and again washed; then it may be chlorinated, such as by treatment with sodium hypochlorite, and then again washed, treated with acid and washed. It may be put in bins while in a wet condition, after which it is passed over devices which open up the cloth, and then it may be dried on steam-heated cylinders and finally wound into a roll. Wide variations may of course be made in this process. As a result thereof, a given piece of cloth has been materially lengthened due to the mechanical pulling of the cloth during the different processing treatments and the cloth is now in what we have herein termed its stretched condition. For example, a piece of cloth 3000 yds. long and 38" wide in the grey or unbleached condition may have been pulled out to 3300 yds. of length and narrowed to 32" in width. In a standard textile printing operation, the bleached cloth would usually be printed at that 32" width while being subjected only to such tension as is required for the printing operation. In our process, we propose to print the resist pattern on the cloth by such a standard textile printing operation, while the cloth is in its stretched or elongated condition. That is, in the example given, the cloth being resist printed is 3300 yds. long and 32" wide.

For the resist of the printing paste, we may use various types of resin, but we prefer to use the amino-plasts and the amide formaldehyde condensation products, and particularly the condensation products of formaldehyde with either urea or melamine, and their homologues. For some purposes, we may use alkyd resins, such as the condensation product of glycerol, a fatty acid and phthalic anhydride; or we may use vinyl resins, such as vinyl acetate.

We prefer to employ a printing paste made of melamine formaldehyde and a suitable thickener, such as starch or sodium alginate. For example, we may make a paste of 15 gals. of melamine formaldehyde and 85 gals. of a 2% aqueous solution of sodium alginate. Color may be added as desired. We may also employ a paste made by cooking 0.75 pound of cornstarch in one gallon of water. 15 parts by weight of melamine formaldehyde is combined with 75 parts by weight of the cornstarch paste. To this mixture is added 10 parts by weight of a 10% solution of NH_4Cl in cold water, the salt serving as a catalyzer for polymerizing the resin. This gives the required consistency or viscosity for the printing operation. If a color design is to be printed, we may add to the printing paste 5 parts by weight, more or less, of a suitable coloring matter, such as a standard yellow pigment.

The starch paste is a thickener employed to give a desired consistency to the printing paste, since the monomeric resin is a heavy oily liquid and not adapted for printing when used alone. Many substances well known to the printer may be employed in place of the starch. We may employ gum tragacanth paste, or a protein thickener or an emulsion of a resin, oil and water proportioned to give the required consistency. The thickener may be omitted if the resin is highly viscous.

The melamine formaldehyde in the above formula is used in the monomeric form, and it is subsequently hardened or polymerized by heat. A partially polymerized resin may be employed in the printing paste, in which case the subsequent treatment is such as to complete the polymerization and render it insoluble and immobilize the stretch of the cloth. It is also feasible to employ in the printing paste only a part of the resin components and thereafter subject the printed article to treatment by the remaining components required to make the insoluble product. For example, the paste may comprise an urea compound which may be subsequently converted by treatment with formaldehyde to form the insoluble resin.

We may employ a composition made of urea formaldehyde resin. For example, we may employ 25 parts by weight of urea formaldehyde with the 75 parts of cornstarch above specified. Also, we may use an alkyd resin composed of a mixed ester of glycerol, phthalic anhydride and soy bean oil fatty acid dissolved in petroleum hydro-carbon and emulsified with water. This may be combined with melamine formaldehyde. For example, a satisfactory resist has been made by using a blend of such emulsified resins. The printing paste may be made as follows: 2.5 gallons of the emulsified alkyd resin blend is dispersed in 15 gallons of a high flash naphtha. Then 7.5 gallons of melamine formaldehyde is dissolved in 20 gallons of cold water. A third solution is made of 2 pounds of ammonium chloride dissolved in 5 gallons of cold water. This latter solution is added slowly with agitation to the melamine formaldehyde solution; then this mixture is added to the resin dispersion and emulsified therewith by means of a high speed mixing apparatus. If desired, this paste may have added thereto any suitable coloring matter, such as a dye or pigment.

In accordance with a further aspect of this invention, we may produce a crinkled or raised pattern cloth in which the immobilized areas have been given a glazed or polished surface. This is accomplished by glazing or polishing the cloth while the resin is in a monomeric, thermoplastic or partially polymerized condition and which has not been brought to its final hardened form. For example, if the cloth has been printed with a paste containing melamine formaldehyde, as above stated, the entire surface of the cloth may be subjected to heat and friction in a calen-

dering operation which produces the glaze. A thermoplastic polymerized resin is brought to an adhesive or semi-plastic condition by the heat so that it is capable of adhering to the crushed fibres of the cloth and holding them in place. The polished or glazed appearance extends over the entire cloth at this time, but the glazed condition disappears in the localized unprinted background when the cloth is later subjected to washing or other operations. Thus, a piece of cloth having a white or an unprinted monotone color may have the crinkled portions presenting a glazed or polished appearance. If coloring matter has been added to the paste, then the printed colored pattern containing the resin is shiny as well as crinkled. The lustre or glazed appearance may be omitted by polymerizing the resin in a hot chamber where the cloth is not subjected to friction or pressure. Or, the resin may be polymerized by passing it over hot drying rolls in which there is no pressure or friction employed. The resin printing paste may be either transparent or translucent and impart no material color effect to the cloth except that of the shiny or glazed condition. Also, the cloth may be dyed either before or after printing and hardening the resist.

After the cloth has been printed by the resin paste, with or without coloring matter, it may be subjected to a standard operation of drying to a substantially dry condition, such as one containing 5% of moisture. The cloth may be quite dry for a melamine resin, since it will not mark off on the cloth. For the urea type of resin, we may dry the cloth to a condition containing 10% or more of moisture. If a glazed appearance is desired, the cloth is subjected to a polishing operation; or this step may be omitted. The polishing may be accomplished by means of heated calendering rolls which subject the cloth to heat and a pressure which may be as high as 40 tons; or it may be passed at a controlled rate between heated calendering rolls, one of which is driven at a higher speed than the other, so that it frictionally wipes across the surface of the cloth. This polishing or glazing operation may involve a temperature of 320 to 400° F., but if the cloth is passed rapidly through this stage, but little polymerization of the resin may be effected.

While the cloth remains in the stretched condition under which it was printed and before any shrinkage is effected, it is subjected to a standard heat treatment which polymerizes the resin or converts it to a stable and insoluble condition. Polymerization of melamine formaldehyde may be accomplished by heating the resin printed cloth to 300° F. for 3 to 5 minutes. This may be accomplished while polishing the cloth or subsequent thereto. It is preferable to combine the two operations, since the thermoplastic polymerized melamine formaldehyde tends to flow under the heat and pressure of the calendering rolls and thus be forced into intimate contact with the surface fuzz of the glazed cloth as well as the warp and weft. This causes both the glaze and the stretch of the weave to be immobilized. The resin is pliable and it is present in such a small amount that the flexibility and softness of the cloth is not materially affected.

A primary feature of this invention lies in the fact that after the resist has been printed on the cloth and the stretch has been immobilized by rendering the resist permanent, the cloth is shrunk to a normal extent and especially to substantially its original length. In other words, we propose to restore the original length of the unbleached cloth by shrinking out the stretch, as it were, in the non-printed portions. Since the immobilized stretched areas retain their original length, they necessarily crinkle when the rest of the cloth is shrunk. At the same time, we have maintained substantially the full length of cloth as originally provided for the grey or unbleached goods.

The shrinking operation may be accomplished by a standard sanforizing treatment, or by a normal laundering and sack drying operation. Sanforizing involves shrinking the cloth back to substantially the original grey length and leaving the cloth in such a condition that when laundered and dried without tension under standard procedure the normal shrinkage thereafter will usually not be over a tolerance of 1%. In this process, the cloth is pulled out to a desired width and then passed through the shrinking treatment, wherein the sanforizer blanket pushes enough cloth, which is wet with water, in between the blanket and a drying drum so as to relieve the longitudinal tension which would otherwise be caused by drying shrinkage and so provide enough cloth warp-wise to restore the original grey length.

Similarly, the resist printed fabric may be shrunk in a slack laundering operation, wherein the fabric is not subjected to tension in the direction of its original stretch, such as lengthwise of the bands of resin resist in a plissé cloth. That is, we may pass the cloth through a standard soap and water laundering treatment, after which it is dried in a slack condition, such as by hanging it in loops or festoons over drying racks and without placing it under longitudnal tension. The cloth may be framed as desired to, say, 36" wide, but the shrinkage is preferably that which restores the original length of the cloth. However, as will be appreciated, wide variations may be made in the dimensions of the cloth. But, it is important that the cloth be not subjected to an abnormal shrinkage, such as is caused by strong acid or caustic alkali, which permanently decreases the grey yardage to a material extent. Hence, by this treatment we are able to make a crinkled cloth from a given piece of goods without losing yardage materially or without decreasing the length of the cloth beyond that normal shrinkage involved in standard laundering and sanforizing treatments.

It will be appreciated that the immobilization of the weave of the cloth is only such as is needed to permit the unprinted portions of the cloth to assume a more highly shrunk condition than the printed portions and that the flexibility or pliability of the cloth is not materially affected. The percentage of resin present in the printing paste and the amount of printing paste employed in a normal printing operation are so small as not to make a stiff cloth or one which does not possess substantially its full pliability. Hence, the term "immobilized" as used in the claims is to be thus interpreted as applied only to that partial immobilization which is needed to provide the desired crinkled effect and yet leave the cloth pliable. Also, such expressions as "cloth of normal texture" are to be interpreted as meaning a cloth which is made of normally twisted yarn or threads and which does not have an artificial shrinkage or tendency to form a crepe when shrunk. The appearance of the cloth will depend upon the shape of the printed pattern. For

example, if the pattern comprises spaced areas, such as a polka dot or a printed figure design, other than spaced bands found in plissé cloth, then the restoration of length of the non-printed portions will cause the resist coated areas to become raised, or in some cases wavy. A small polka dot design would tend to be raised, while a much larger figure would be both raised and wavy. These types of product are herein termed "crinkled" and are intended to be within the scope of this invention.

It will now be understood that many modifications may be made in the steps of the procedure and the product, as well as the composition of the printing paste to obtain varied results. Hence, the above disclosure is to be interpreted as setting forth the principles of our invention and not as imposing limitations on the claim appended hereto.

This case is a continuation-in-part of our copending application, Serial No. 511,349, filed November 22, 1943.

We claim:

The method of making a crinkled, non-creped cloth comprising the steps of providing an unbleached cloth of normal non-creping twist and texture, bleach processing the cloth and stretching the weave only warpwise to a greater length, printing the cloth in said warpwise stretched condition with localized areas of a hardenable melamine formaldehyde resin resist, drying the cloth, polishing and glazing the dry cloth, hardening the resin while the polished cloth is held in said prestretched condition and immobilizing the glaze and the stretched weave only in the printed areas, and thereafter wetting and drying the cloth in a slack laundering operation to restore substantially the original pre-bleached warpwise length and provide a cloth which is not materially shrinkable under standard laundering conditions, and causing the resin printed areas to be permanently crinkled substantially wholly by said change in length.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,511,212	Bliss	Oct. 14, 1924
2,022,391	Smith	Nov. 26, 1935
2,103,205	Myers	Dec. 21, 1937
2,121,005	Bener	June 21, 1938
2,121,755	Heberlein	June 21, 1938
2,123,153	Rivat	July 5, 1938
2,200,389	Finlayson	May 14, 1940
2,239,914	Heberlein	Apr. 29, 1941
2,319,903	Huey	May 25, 1943

FOREIGN PATENTS

Number	Country	Date
484,094	Great Britain	Apr. 29, 1938
504,666	Great Britain	Apr. 28, 1939
521,660	Great Britain	May 28, 1940